

3.7

Translations

Goal Identify and use translations.

VOCABULARY

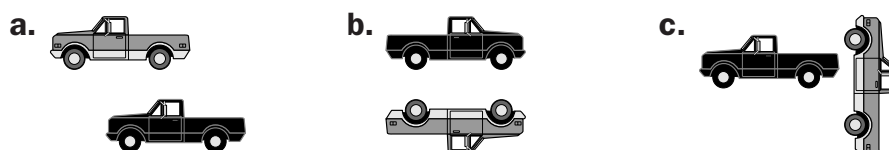
Translation A translation is a transformation that slides each point of a figure the same distance in the same direction.

Image An image is the new figure that results from the transformation of a figure in a plane.

Transformation A transformation is an operation that maps, or moves, a figure onto an image.

Example 1 Compare a Figure and Its Image

Decide whether the gray figure is a translation of the black figure.



Solution

- a. This is a translation because the orientation has not changed.
- b. This is not a translation because the orientation has changed. The image is a reflection of the original figure.
- c. This is not a translation because the orientation has changed. The original figure is rotated 90° .

Example 2 Describe Translations

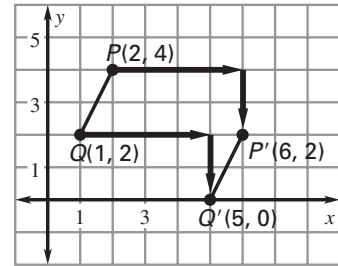
Describe the translation of the segment.

Solution

To get from point P to point P' , move 4 units to the right and 2 units down.

To get from point Q to point Q' , move 4 units to the right and 2 units down.

So, every point on \overline{PQ} moves 4 units right and 2 units down.

**Example 3** Use Coordinate Notation

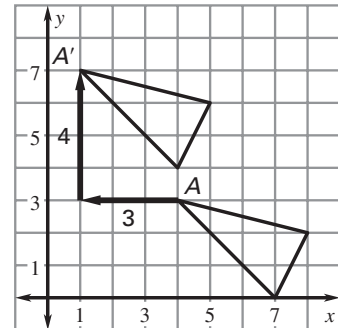
Describe the translation using coordinate notation.

Solution

To get from point A to point A' , move 3 units to the left and 4 units up.

Use $(x, y) \rightarrow (x + a, y + b)$: $a = \underline{-3}$ and $b = \underline{4}$.

Answer The translation can be described using the notation $(x, y) \rightarrow \underline{(x - 3, y + 4)}$.



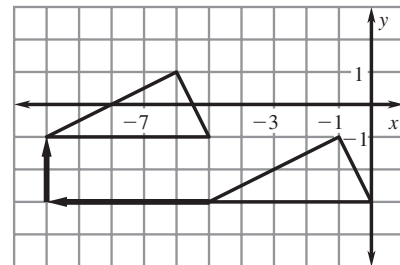
✓ **Checkpoint** Complete the following exercises.

1. Decide whether the gray figure is a translation of the black figure.



No

2. Describe the translation using words and coordinate notation.



5 units left, 2 units up;
 $(x, y) \rightarrow (x - 5, y + 2)$

Example 4**Draw Translated Figures**

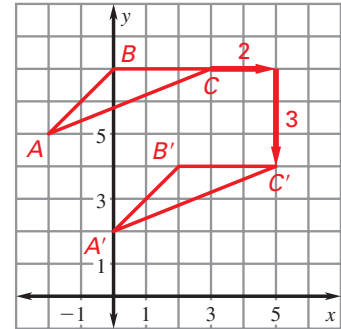
Draw the triangle with vertices $A(-2, 5)$, $B(0, 7)$, and $C(3, 7)$. Then draw the image of the triangle after the translation given by $(x, y) \rightarrow (x + 2, y - 3)$.

Solution

Plot points A , B , and C . Draw $\triangle ABC$.

For the translation $(x, y) \rightarrow (x + 2, y - 3)$, slide each point 2 units to the right and 3 units down.

Plot points A' , B' , and C' . Draw $\triangle A'B'C'$.



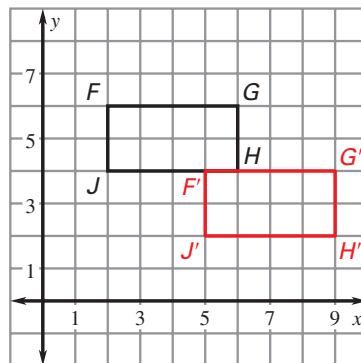
Follow-Up Use the translation in Example 4.

Complete the table below to show how the coordinates of $\triangle A'B'C'$ relate to the notation $(x, y) \rightarrow (x + 2, y - 3)$.

$\triangle ABC$	$\triangle A'B'C'$
$A(-2, 5)$	$A'(-2 + 2, 5 - 3) = A'(0, 2)$
$B(0, 7)$	$B'(\underline{0 + 2}, \underline{7 - 3}) = B'(\underline{2}, \underline{4})$
$C(3, 7)$	$C'(\underline{3 + 2}, \underline{7 - 3}) = C'(\underline{5}, \underline{4})$

Checkpoint Draw the image after the given translation.

3. $(x, y) \rightarrow (x + 3, y - 2)$



4. $(x, y) \rightarrow (x - 3, y + 4)$

